

method by which electrical connections may be made to the row and column electrodes of the tile.

[0025] FIG. 10 is a cut-away view of the tile shown in FIG. 9 along the line F10 which illustrates an exemplary contact structure for a column electrode.

[0026] FIG. 11 is a cut-away view of the tile shown in FIG. 9 along the line F11 which illustrates an exemplary contact structure for a row electrode.

[0027] FIG. 12 is a partially exploded perspective view of a tiled display device having the structure shown in FIG. 1 or FIG. 2 which is useful for describing an exemplary mounting method and an exemplary implementation of a black matrix for the display device.

[0028] FIG. 12A is a detailed view of a portion of the partially exploded perspective view shown in FIG. 12.

[0029] FIG. 13 is a cut-away side plan view of a portion of the glass plates of two adjacent tiles which shows how the tiles may be joined by a mullion such as that shown in FIG. 14.

[0030] FIG. 14 is a perspective view of a mullion suitable for joining tiles to form a tiled display having contrast enhancement features according to the present invention.

[0031] FIG. 15 is a cut-away side plan view of the glass plate of a pixel for a display device having the structure shown in FIG. 1 or FIG. 2 which is useful for describing a method for forming a black matrix for the display device.

[0032] FIG. 16 is a cut-away side plan view of the glass plate of two pixels of adjacent tiles having the structure shown in FIG. 1 or FIG. 2 which is useful for describing a method for forming a black matrix across tile boundaries.

[0033] FIG. 17 is a cut-away side-plan view of adjacent pixels of a display device such as that shown in FIG. 1 or FIG. 2 which is useful for describing a method for forming a black matrix for the display device.

[0034] FIG. 18 is a graph of glass thickness versus black matrix line width which is useful for describing a contrast enhancement feature according to the present invention.

[0035] FIG. 19 is a cut-away side plan view of an exemplary display structure which employs a lens structure to concentrate light provided by the active pixel area into a relatively small aperture.

[0036] FIG. 20 is a cut-away side plan view of an exemplary two-part display structure.

#### DETAILED DESCRIPTION

[0037] In the exemplary embodiments described below, the drawing figures are not to scale. Indeed, features of the drawing figures have been exaggerated in order to facilitate description of the invention.

[0038] Contrast enhancement depends, at least to some extent, on the kind of display device. The present invention is described in terms of an emissive display device which uses OLEDs for the active pixel element. It is contemplated, however, that the contrast enhancement techniques disclosed herein may be used with other types of emissive displays, for example, electroluminescent, cathodoluminescent, and plasma displays as well as for reflective and light

valve displays, such as liquid crystal display devices. An exemplary reflective display may be formed, for example from Bistable, Reflective Cholesteric (BRC) liquid crystal material which provides for a low power, bistable display. It is helpful to understand the structure of the display device in order to understand how contrast enhancement features according to the present invention may be used with the display device.

[0039] FIG. 1 is an exploded perspective drawing which illustrates an exemplary structure of an OLED display device 100. The device shown in FIG. 1 may be formed as a separate electronics section and display section or it may be formed a single unit. As described below, connections to the row and column electrodes of the display device are made along two perpendicular edges of the device.

[0040] When the display device shown in FIG. 1 is formed as a single unit, it is built on a circuit board 110. This circuit board may include, for example, an electronics module (not shown) which provides the row and column driving signals for the display device. The electronics module is coupled to the row and column electrodes of the display device through column vias 112 and row vias 114. Only one row via 114 is shown in FIG. 1. The row vias 114 connect to row electrodes 116 which may be painted or printed on the top surface of the circuit board 110. The display material 118 is deposited on top of the row electrodes 114. In the drawing FIG. 1, the display material 118 is illustrated as a solid sheet. This material, however, may be individual OLED cells including an electron injecting material such as calcium, a light emitting polymer layer and a hole transport polymer layer. Alternatively, cells of another emissive material may be deposited on the row electrodes 114. The row electrodes 114 may be formed from a metal such as aluminum, magnesium or calcium or from polysilicon.

[0041] Column electrodes 122 are formed on top of the display material 118. The column electrodes 122 are connected to the circuit board through the vias 112 which extend through each level of the display tile from level 110 through level 118. Each column electrode 122 is electrically coupled to a respectively different via 112. The column electrodes 122 are typically formed from a transparent conductive material such as indium-tin oxide (ITO). In the exemplary embodiment of the invention, level 121, formed above the column electrodes 122 may be an optical filter such as a neutral gray filter, patterned color filter or polarizing filter. Alternatively, level 121 may be a patterned black matrix which covers the inactive areas of the display layer 118 with black lines while providing openings for the active elements of the display material.

[0042] When the level 121 is a neutral gray or patterned color filter, it may act to enhance the contrast of the display because ambient light that passes through the filter and is reflected by the display material passes through the filter twice while light provided by the active pixel elements only passes through the filter once. The patterned color filter, is formed with individual filter sections covering corresponding pixel colors (e.g. red filters over red pixels). These filters have a further advantage as most of the ambient light will be absorbed while very little of the light provided by the active pixel element is absorbed.